ORIGINS

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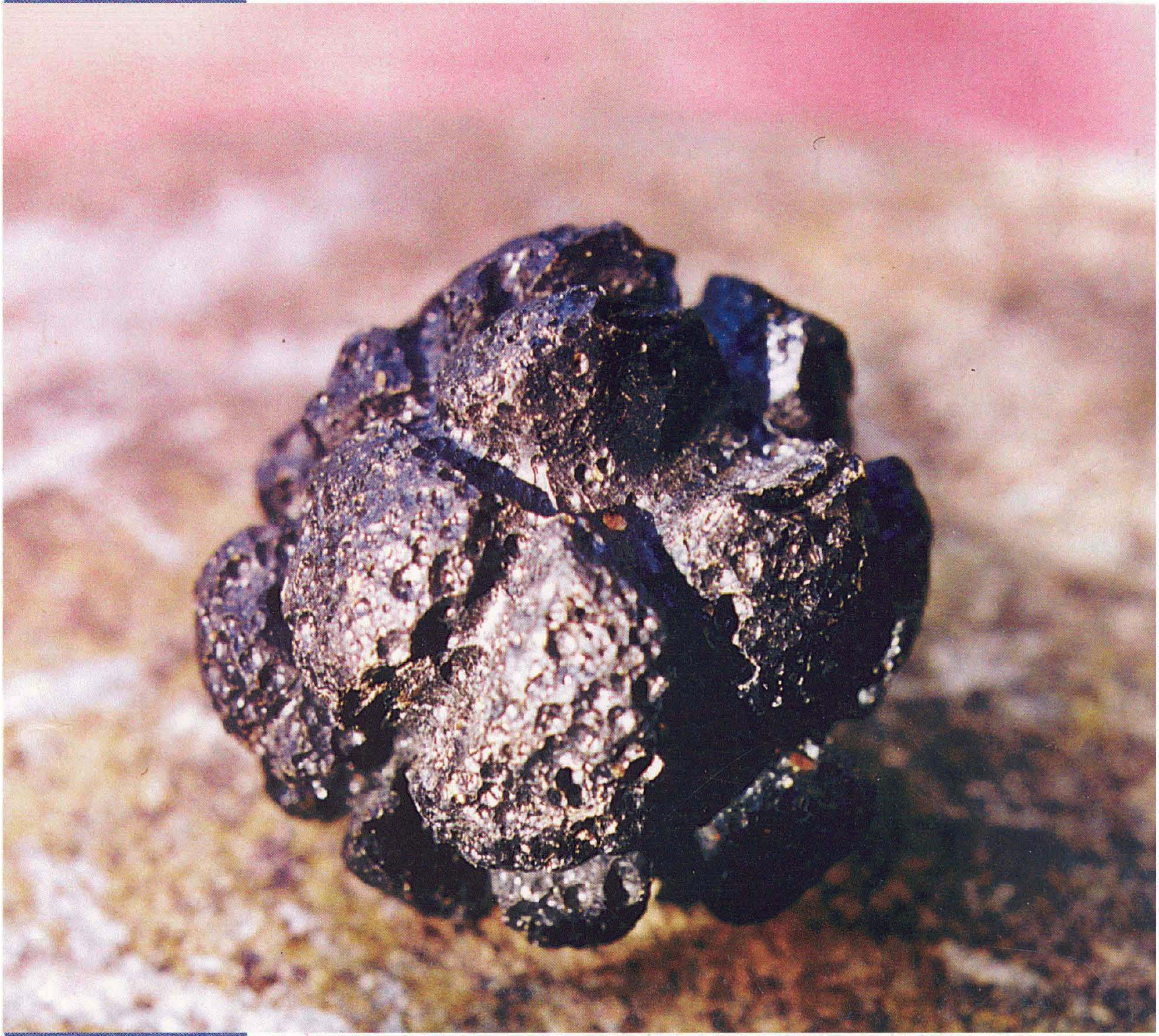

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The Bible and Chronology

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Writing for Origins

Origins is looking for talented new writers, particularly those who have had experience in a specialised field of science or theology, in relation to creation, and who are in agreement with the aims and basis of the BCS. In addition, writers in a popular vein are needed, but accuracy and solid content are still essential. Any manuscripts for consideration should ideally be typed, double-spaced and sent to the Editor. Notes of guidance to authors are available on request. News items that may be of interest are also sought. We now welcome articles on disk in most formats, but 3½ ″ HD, Wordperfect 5.1 or ASCII preferred; media will be returned after transfer of the file.

Editorial Policy

Whilst **Origins** exists to further the aims of the Biblical Creation Society, opinions expressed in articles and signed editorials are not necessarily shared by either the Editorial Committee or the Society.

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Editorial

THE BCS committee met in October last as a part of their regular review and planning of the work of the Society. We were much encouraged with a number of developments over the past year. In particular, we have been grateful to the Lord for an increase in the number of opportunities for our members to speak at meetings or contribute to articles in magazines and papers other than our own. We are increasingly conscious of the spiritual nature of our work and urge you to pray with us and for us.

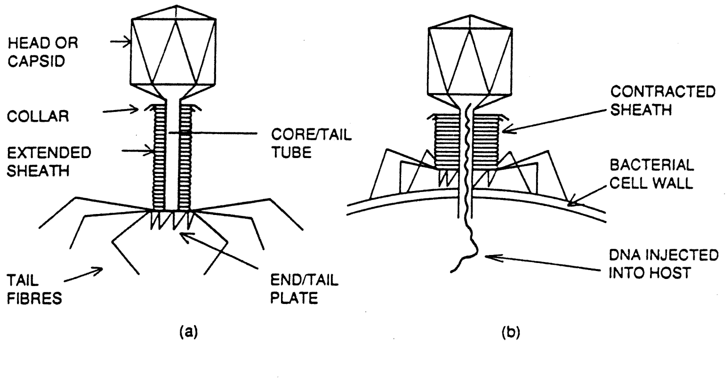
You can help us in many ways and ideas are circulated to members from time to time. Are you a member? There are a number of subscribers to the journal—and we welcome you to our readership!—but we need more members. More members will provide us with an increased prayer force. Why not distribute some membership forms in your church, college C.U., *etc.*? What about organising a meeting in your area? Several churches have organised open meetings in 'neutral' buildings so as to attract other christians and especially non-christians. Have you ever thought of this as an evangelistic opportunity? We believe that the theory of evolution does dampen evangelistic fervour. In contrast, a belief in special creation should spur us on in evangelism.

We are often struck by the fundamental weaknesses in the evolutionary theory. In spite of the very positive publicity given to evolution in the media, we do occasionally see an admission of fundamental problems. During October 1994 there were interesting comments on the age of the universe. A Channel Four programme on the *Rubber Universe* looked at the measurements of the Hubble Constant and the problems raised. To be consistent with the evolutionary theory (Big Bang), the Hubble Constant would have to be around 40+. In fact, it is found to be nearer 80, giving a universe younger than the stars! This was reinforced by an article in *Nature* reporting on measurements made by the repaired Hubble Telescope. (See references for details of papers.) The consequence of such a 'high' value of the Hubble Constant is that the universe can only be half of its projected age! A figure of 8,000 million years has been quoted, whereas the stars are supposed to be 14,000 million years old. Psalm 2:4 comes to mind.

In interpreting experimental data, we must take into account all the facts. The Bible tells us that the universe was miraculously created. Inevitably it will have the appearance of a scientific age immediately. If we were to observe an orbiting star one minute after creation, it would have apparently been in that orbit for much longer—there is no way to know. But God has not deceived us on this point—He has told us when and how He created the universe.

Another report earlier in the year (in *The Daily Telegraph*) described the analysis of a meteorite that landed in Australia 25 years ago. The writers concluded, 'From this it becomes clear [that] the sun … the planets and the parts of this meteorite, took their general shape within less than a million years'. They believed that the matter which formed the sun and the planets came from a super-massive star 5,000 million years ago. Even if we accept the figures derived by these scientists, the earth is apparently only three quarters of a million years old! Hmm! where does that leave the theory of evolution? Having gradually pushed the universe to increasingly greater ages to suit their needs, they are now being forced to reduce it back down again.

From the huge universe to the sub-microscopic living organisms we are faced with amazing testimonies to the marvellous handiwork of God. Consider designing a fully automatic hypodermic syringe which could locate its victim and inject it with its contents. Now reduce that marvellous structure to the size of a bacterium! This is the amazing nature of the bacteriophage (Peet, 1994). This is just one of the marvels of the microscopic world of creation. Kevin Charman has written our lead article this month and opens our eyes to this wonder of creation. I hope that, as you read it, you will be as enthralled as I was. But, don't forget to praise the Maker!



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Creation in the News

Who or What is Australopithecus Ramidus?

THE PRESS recently announced the discovery of a 'missing link' (or one of them!) between man, the apes and their supposed evolutionary ancestor. How do we view this in the light of Scripture?

The Bible makes it clear that the first man was Adam who was created from the dust of the earth in the image of God. So, how does the discovery of *Australopithecus ramidus* fit in?

First of all, forget the pictures in the newspapers showing an upright, hairy ape-like man. Even Dr. Chris Stringer, an evolutionary expert at the British Museum who specialises in this field, indicated that such conjectures were premature. There were insufficient finds to warrant such a claim.

In fact, Dr. Tim White and his team carefully note six times in their research paper (White *et al.*, 1994) that the remains were most closely related to a chimpanzee. David Keys, in *The Independent* newspaper, correctly drew attention to the Bonobo Chimpanzee at Twycross Zoo which demonstrates a close resemblance to this Ethiopian creature.

So, how do the researchers reach the position of believing that they have found a missing link? Basically through their preconceptions. They, like creationists, start with a premise which determines their interpretation of the data. The reports demonstrate this well. Dr. Gen Suwa is quoted in several papers. He was walking across ground covered with thousands of pebbles when he saw a bone glinting in the sunlight. 'I knew immediately it was a hominid'. Hardly good science!

Seventeen bones (or fragments) were found; most of these were teeth (the others were a skull fragment, a partial lower jaw and an arm bone). They were scattered over a distance of two miles. The science editor of The Times, Nigel Hawkes, made several perceptive comments. 'Few sciences produce such abundant returns from so few fragments of fact as palæontology'. Its success rate in terms of long-term acceptance of the results makes this comment sound a little sarcastic!

The researchers found that the bones lay on volcanic rock dated by potassium-argon techniques to 4.6 million years. So, that would be their maximum age. Leaving aside the validity of such geochronological methods, is the date significant for the supposed evolution of man? The proposal is that *ramidus* developed through successive changes to modern man who appeared on the scene four million years later. Fossil bones found in Tanzania indicate that true humans were there nearly two million years ago. Footprints in strata nearly four million years old (in Laetoli, Tanzania) appear to be truly human. A humeral fragment was found in Kanapoi and is morphologically indistinguishable from *Homo sapiens* and yet is over four million years old (Lubenow, 1992).

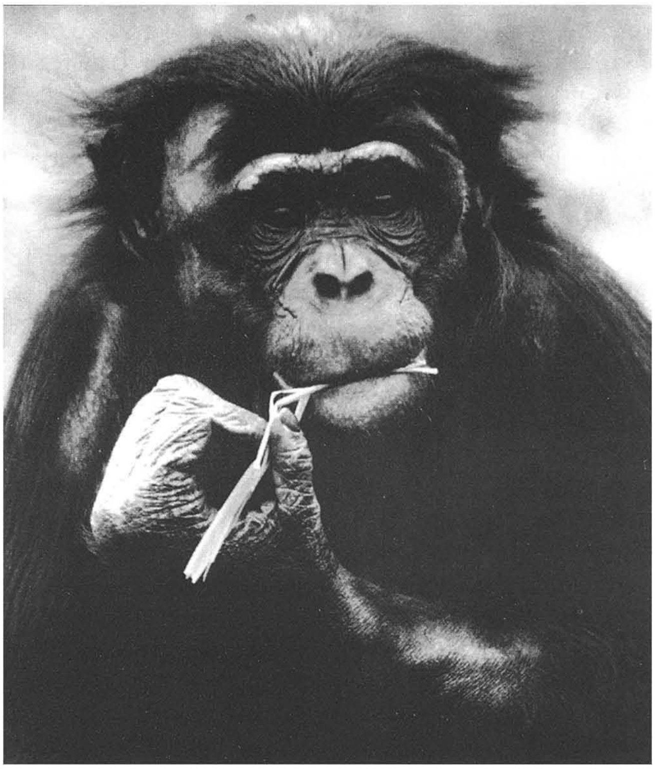

Photo Courtesy of Twycross Zoo

Bonobo at Twycross Zoo

Does it matter? To quote Nigel Hawkes again, 'Darwin's other revolution was to displace man from his position as a creature apart'. *The Independent's* cartoon by Colin Wheeler says it all. An ape-like creature is followed by a stooping ape-man and then a man. The man is writing, 'God created the world'. Quite an evolutionary jump!

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The Fascinating World of Micro-Organisms

Design at the microscopic level

Kevin M. Charman

FOR MANY years micro-organisms remained invisible to man, who was largely unaware of their presence all around him in every environment. Even when microbes made their presence known, the true identity of the causative agent went unrecognised. Admittedly man used various fungi and bacteria, even in ancient times, for his own purposes, as evidenced in God's Word in several places (Exodus 12:15; Numbers 6:3; 2 Samuel 17:29).

However, it has only been relatively recently that we have begun to probe the mysteries of the microbe. With this increased knowledge, man has begun to exploit the potential of a wide range of micro-organisms, both in what the organism is capable of doing and how it does it. In this article the intention is to explore this briefly and to see how God the Creator has made provision in His Creation for our needs.

It is certain that some of the exploitation of microbes (this includes fungi, bacteria, viruses, algæ and some would include protozoa) is in part fulfilling God's command to Adam to use and take care of the created order (Genesis 1:28; 2:15; Creation Manifesto, 1988a) and to exert control or dominion over it (Genesis 4:3, 20–22; Deuteronomy 8:7–9; Creation Manifesto, 1988b). Although this exploitation is undoubtedly tainted by the effects of man's sin—greed, pride and even the desire to displace God as the Creator—there are still the clear marks of the image of God in man as he interacts with creation and as he shows imaginative use of the resources God has given.

Locomotion Bacteria-Style

Let us consider some physical characteristics and actions taken by some selected bacteria. The bacterial genus *Proteus* contains bacteria that may be found in the environment and in the human gut. These bacteria are often seen to be very motile, swimming quite rapidly in liquid culture. However, when these bacteria are taken from a liquid environment and put onto agar (the gel which, combined with various chemicals, is used by microbiologists to culture many microbes), a metamorphosis occurs. From being an average-sized bacterium (1.5–2.0 µm in length) that swims using 6–10 flagella (long, thin appendages acting like propellers), *Proteus* becomes very elongated (60–80 µm in length) with hundreds to thousands of flagella and now possesses the ability to swarm.

This metamorphosis is induced by any surface *e.g.* the agar surface, and the elongation of the cell is a result of a delay in septation (the process of cell division). These changes are necessary for the cells to be able to move about on a surface in order to reach nutrients and a greater body of water. Individual cells cannot swarm, nor can the smaller swimmer cell. Swarming is a result of the effects of coordinated, multicellular groups of swarmer cells. A mass of swarmer cells move forward propelled by flagellar rotation against the surface and other bacteria, until they have thinned out. Swarming then stops, the swarmer cells differentiate (cell division takes place) into swimmer cells resulting in a large increase in the number of cells. The swimmer cells then differentiate into swarmer cells (by growth, non-septation and increase in the number of flagella) with the concomitant increase in the bacterial mass. The whole process of swarming then repeats itself. The resultant effect as seen on an agar plate is a series of concentric circles radiating from the inoculation point. The waves that are seen are the points at which differentiation has occurred. The swarming is very regular and is not merely controlled by the mass of the group of bacteria; rather some signalling system is involved which allows the waves of swarming, differentiation, consolidation, differentiation and swarming to occur in a coordinated fashion. Not only is such a signalling system required, but it must involve some sort of extracellular communication.

Vibrio and *Serratia* are other genera of bacteria which show similar processes to swarming as in *Proteus*, and may give a clue to some of the mechanisms involved in swarming. *Vibrio parahœmolyticus* has a single polar flagellum which has a sensory capacity by monitoring external conditions that inhibit flagellar rotation. Therefore at a certain point when the inhibition is sufficiently great, a mechanism signals the cell to elicit the change into a swarmer cell. In the case of this organism, the cell develops hundreds of lateral flagella which are different in composition to the polar flagellum. This then is a swarmer cell that can move over surfaces (Belas, 1992).

The swarming mechanism relies on several factors:

(i) the detection of a change from liquid to surface conditions.

(ii) a very significant change in the morphology *e.g.* development of new features or an alteration of the normal cell cycle (growth and multiplication).

(iii) successfully overcoming the physical barriers of moving across surfaces *e.g.* increasing the number of propulsion units (flagella).

(iv) a signalling system (to coordinate swarming) that can be propagated over distances a thousand times the length of the individual bacterium.

Glossary

Bioremediation:	the use of organisms and biological processes to reclaim polluted environments.
Eukaryote:	cells having a nucleus and other organelles surrounded by a membrane.
Exopolysaccharide:	a sugar polymer that forms part of the cell's external matrix and may be released into the surrounding medium.
Fibrils:	ultrastructural fibres used in various ways within the cell *e.g.* structure, locomotion
Magnetotactic:	ability to detect magnetic field and move with reference to that field.
Metabolites:	the products of any material that is metabolized.
Nanotechnology:	technology based around microscopic (usually the nanometre) scale materials and engineering.
Osmotic pressure:	the pressure required to prevent the movement of water from a more dilute to a more concentrated solution.
Plasmids:	small transferable segments of DNA.
Prokaryote:	having cells in which the DNA is not surrounded by a nuclear membrane.
Proteolytic:	ability to break down proteins.
Recombinant virus:	DNA extracted, opened up, new DNA added, the DNA closed up and put back in the virus:the virus is recombined.
Rheology:	the study of the flow properties of a material.
Ribosomes:	cellular elements involved in protein synthesis.
Sporangium:	the spore bearing part of the fungus.

By human standards, to achieve such a feat would require considerable technology and design. To achieve that in a package the size of a bacterium would be impossible even with the latest advances in nanotechnology. God has done all this and given the bacterium a vast array of other abilities into the bargain. Man is constantly looking for better, more effective, more efficient means of moving from A to B, especially from one environment to another and has come up with some ingenious methods, but surely here is a truly inspired way of meeting a new environment—almost totally transforming the physical characteristics to meet the challenge of a different set of physical problems.

The propeller is a larger slightly modified version of the flagellum; the caterpillar track also has its counterpart, albeit attained by a different structural arrangement but with the same propulsive effect. A bacterial example of a caterpillar track propulsion system can be seen in the gliding bacteria. Many species of bacteria exhibit such a property, but how it works is far from clear. Microscopy of such bacteria reveals that flagella are not responsible. Nor have any other external appendages been found to be the means for carrying out this sort of motion. Some clues have been found using ultrastructural studies (See figure 1). Fibrils in the periplasmic space directly below the outer membrane have been shown to run parallel to each other in wide bands passing over the poles of the cell. Other fibrils appear to be helically wound around the cell in a dense layer. By contraction in an organised, rhythmic fashion, these fibrils may cause wave-like distortions within the fibril layer, which are then translated directly to the adjacent outer membrane. The result would be a set of ridges 'moving' down the length of the cell, thus propelling the cell forward (Lunsdorf, 1989), a type of motion seen in slugs and snails. It seems that man designs methods of locomotion and when he sees its counterpart in nature attributes its presence to chance rather than intelligent design. As we discover more of the intricacies and complexities of God's creation we will see more clearly how even the smallest of creatures is fearfully and wonderfully made and that all God's works are wonderful (Psalm 139:14).

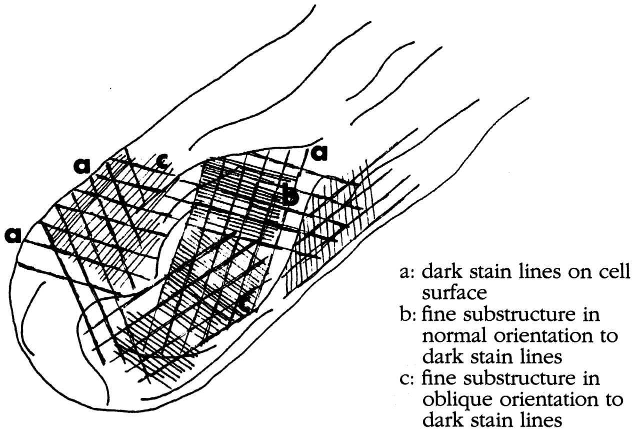

a
c
a
b
a
c
a: dark stain lines on cell surface
b: fine substructure in normal orientation to dark stain lines
c: fine substructure in oblique orientation to dark stain lines

Fig.1: Drawing of a negatively stained cell of M. fulvus showing a regular helical surface pattern.

Bacterial Giants

Another member of the bacterial world is *Epulopiscium fishelsoni*, amazing because of its size. The majority of bacteria are only about 1–2 µm in length although some species may be longer—in the order of a few tens of microns (a micron, 1µm, is a millionth of a metre). *E. fishelsoni* is a monster amongst bacteria. It inhabits the intestinal tract of the brown surgeon fish of the Red Sea, and individual cells greater than 600x80 µm have been observed—these bacteria are so big you can almost see them with the naked eye. To give a better idea of the enormous size, consider *Escherichia coli*, the common gut inhabitant and a typical size for many bacteria—*E. fishelsoni* has a cellular volume more than one million times greater than *E. coli*. Indeed, other bacteria may rival this giant in terms of length but they have a much smaller cell volume—*e.g. Spirochæta plicatilis*, 250x0.75 µm which although about half the length and a hundredth the diameter, the volume is so much smaller that it would take more than 25,000 of the spirochæte cells to match the volume of a single cell of *E. fishelsoni* (Angert, 1993).

The greater sized cell in terms of volume usually requires a particular mechanism for overcoming size-limiting barriers. For prokaryotes especially, this includes the movement of nutrients and metabolites (normally by diffusion). In this case, no special transport system has been found even though the size of this bacterium surprised the scientists who found it. These observations indicate that bacteria can be orders of magnitude larger than previously supposed. Factors previously thought to be determinants for the limits of prokaryotic cell size and which have only been overcome in the eukaryotes—by the use of organelles and subcellular structures—may be misjudged or even totally in error. In fact, these cells are larger than many eukaryotic cells and provide a challenge to the evolutionary biologist who claims that 'the small size of prokaryotes drastically limits the opportunity for internal structure' (Dyson, 1978). Are organelles and an internal subcellular structure necessary for large cells? Further he maintains that the 'prokaryotic cell is an early stage in the evolution of the far more complex eukaryotic cell' (Stanier, 1976, p.86). Why evolve into a more complex cell when one that is less complex can achieve the same end? Rather, the differences between the two types of cell indicate a completely independent origin, and may be evidence to put against current thought which claims eukaryotes are cells which have 'ingested' prokaryotes and over time have transformed the prokaryotes into organelles such as the mitochondrion.

Bacteria that Live Forever?

Prokaryotic cells also show remarkable longevity in certain circumstances. Bacteria which are in the vegetative state are unlikely to survive for more than a few weeks in conditions unsuitable for multiplication. However bacteria can go into a state of 'suspended animation'—or cryptobiosis—a state in which they show extremely little or no metabolic activity but still retain the ability to resume growth when environmental circumstances change. They may enter the state of cryptobiosis in several ways—the formation of spores, freezing or drying. Spore formation occurs as a response to stress and is a result of a sequence of developmental changes whereby the vegetative cell is transformed into a relatively dry dormant body covered with a tough coat. Although spore formation is not generally common across the bacterial genera, where they are formed they are very resistant to freezing, drying, chemicals and heat (some even survive brief autoclaving).

Alternatively, cryptobiosis may be attained by passive pressures outside the control of the bacterium, such as freezing or drying conditions. Some bacteria have special solutes that act as cryoprotectants—not necessarily 'anti-freezes' but compounds which protect the cells from freezing damage. Cryoprotectants work at low concentrations and include sugars, detergents and polymers and work not only when cells are frozen, but also in drying (which is a similar process in which water available to act as a liquid solvent becomes more limited). Bacterial survival may also be enhanced by the death and lysis of other bacteria in a dense community as some cellular components may act as cryoprotectants. In the natural environment bacterial populations may well protect each other in this manner, but the soil also provides an environment rich in carbohydrates, proteins and other soluble polymers, protecting bacteria from damage due to freezing and dehydration.

By these means God has provided a way of preserving an essential part of the natural recycling process in nature. Degradative and assimilative bacteria, that break down organic matter and release nutrients into the soil to make it fertile, have been designed by God to survive the seasonal variations in climate. This is not the only means that God has used to maintain His Creation; He has also enabled some bacteria to operate their degradative processes at temperatures at around 0°C (Gounot, 1991).

Dormant bacteria may remain viable for periods of many years. An upper limit for survival time has not yet been established, although with freezing and a good cryoprotectant nearly all the bacteria will survive the actual freezing. With time the population slowly dies—with lower temperatures favouring longer survival. The rate of decline of viability as determined experimentally, suggests a maximum survival time of 40 years for frozen vegetative bacterial cells. Spores, however, are different and various scientists claim to have isolated spores that were viable, from sources that were hundreds, maybe thousands of years old. Despite some of the methodologies that have been used by some and later found to be deficient in some way as regarding protecting the sample from contamination from other sources, the results can give some meaningful indications that spores are capable of remaining viable for up to several thousand years. Some scientists in the field have wondered 'Why do spores die at all?'—others have even asked, 'Do spores die?' (Postgate, 1990). The decrease in spore numbers may be accounted for by germination and then death of the vegetative cell due to a rapid change in environmental conditions. The time limit for microbial cryptobiosis is an open question. Are there spores somewhere in the world that have been dormant since the early days of Creation?

Bacteria Living on the Edge

Some like it hot! The filamentous, gliding bacteria of the genus *Beggiatoa* have been found not only around, but also covering, hydrothermal vent sites in the Gulf of California. Some organisms recovered were in a class containing filaments measuring 116–122 μm in length. These bacteria appeared at this site in quantities several orders of magnitude greater than that previously observed at any other site. The mats of these filamentous organisms were discovered to be virtual monocultures, *i.e.* only these organisms and no others—a unique phenomenon not before observed in the natural state. These bacteria are unusual in another respect—the amount of cytoplasm is relatively small and all of it is distributed along the outer cell wall. Approximately 15% of the cross-sectional area is composed of cytoplasm and cell wall, the remainder of the inner space is a large liquid vacuole. This could allow cells to grow to enormous size without diffusional problems (the cytoplasmic volume is kept down) giving the organism the structural rigidity necessary to exploit larger ambient space than smaller filaments without the support of the substratum. The inner large liquid vacuole could also act as a low-redox reservoir for reduced chemical species when outside the level is diminished by occasional oxygenated sea water flushes of the area (Jannasch *et al.*, 1989).

Other thermophilic organisms have been isolated from production fluids from oil reservoirs at a depth of about 3,000m below the bed of the North Sea. Bacteria in these cultures grew at temperatures between 85–103°C—similar to *in situ* reservoir temperatures. Some of these organisms grew at pressures up to 350 atm. These hyperthermophiles may be part of high temperature communities and could be responsible for *in situ* bioconversions of crude oil fractions at temperatures previously considered too extreme for biochemical reactions (Stetter, 1993). There is evidence that thermophilic microbes synthesise enzymes that are inherently more heat-stable than those produced by organisms growing at lower temperatures (some enzymes from thermophilic organisms have been shown to remain functional at 120–130°C, and are 10 to 100–fold more stable than existing equivalent enzymes from other sources, which typically do not survive very long above about 55°C) (Borman, 1991). The increased stability is basically attributable to a favourable secondary and tertiary structure (Rose, 1976) and in some cases to an increase in the number of salt bridges (Potter, 1992). Some researchers think that such bacteria represent or are similar to the earliest life forms that first appeared on Earth when it was much hotter than it is now! This means that they 'haven't adapted to a hot environment. Instead, it's all the other organisms that have adapted to a low temperature environment. That's a very interesting train of thought!' (Borman, 1991). Therefore the first enzymes must have been more complicated than more recent ones—with more cross-links to help maintain structural and conformational integrity. The fact remains however that such enzymes can be of great use to man in various processes—the higher temperatures allow reaction rates to be greatly increased. The knowledge about stabilizing factors may even allow the modification of enzymes for which there is currently no high temperature counterpart.

Coping under pressure! Some of the bacteria that have already been mentioned have grown at high temperatures and moderate pressures (up to 350 atm). The pressure specialists are the barophilic organisms, which are also found in ocean depths. Due to the technical difficulty of studying organisms under great pressures, little is known about them. However, several obligately barophilic organisms have been discovered. One such isolate was recovered from a depth of 10,476 m, at a pressure of 103.5 MPa (more than 1,000 atm) and at a temperature of 2°C. When this organism was decompressed to atmospheric pressure (0.101 MPa) and 0°C over a period of time, distinct morphological changes were observed by ultrastructural analysis. As to how the organism can survive at such pressures, it appears that there are special stabilising proteins that are formed and bind to particularly labile cell components, such as nucleic acids to prevent them collapsing or forming non-functional structural conformations at high pressures (Chastain *et al.*, 1991).

Surviving in salt! Salt has long been used as a preservative of food to stop microbes from degrading the food during storage. Such a procedure would not be effective in preventing the growth of a group of organisms known as halophiles. These microbes not only survive in salty conditions, they thrive and some actually require the presence of salt in significant concentrations to allow growth! Halophiles such as *Halococcus sp.* and *Halobacterium sp.* have a minimum requirement for sodium chloride of 2–2.5 M, and an optimum of 4–5 M, for growth (a saturated solution of sodium chloride is about 5.2 M) (Stanier, 1976, pp.571–572). The significance of this can be highlighted when one considers the fact that at high concentrations of sodium chloride (above 2–3 M) most enzymes are inactive. The biochemical mechanisms *e.g.* enzymes and ribosomes, of the cells of these bacteria are salt requiring and function most effectively at concentrations of salt near to saturation.

Bacteria are not alone in their halophilic properties—there are, unsurprisingly, algæ that are also members of this group. Strains of *Dunaliella* are eukaryotes that are very halophilic and they possess a protein that is similar to soya meal that has been used as a feedstock. On a protein basis, the productivity of *Dunaliella* is approximately 100 and 50 times greater than crop production and fish farming respectively. To tolerate hypersaline conditions the physiology of this organism allows it to accumulate up to 30% of its biomass as glycerol, with the consequent effect of reducing the osmotic pressure and hence dehydration. (The problem of high osmotic pressure in hypersaline conditions is something all of the halophiles face). Although not yet economically viable (due to the petrochemical industry) some mutants of *Dunaliella parva* are able to excrete up to 90% of the glycerol they produce.

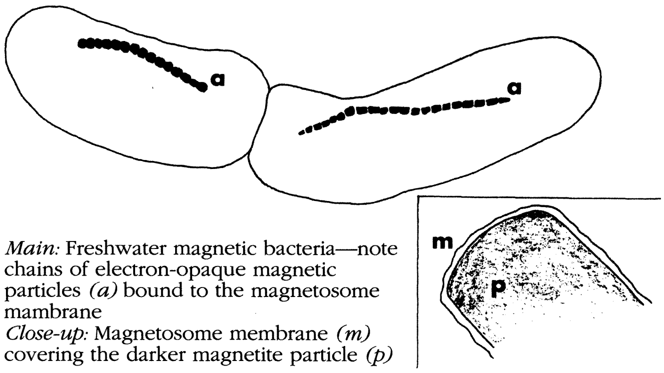
The products of several halophiles have great potential. *Halobacterium mediterranei* produces an exopolysaccharide with excellent rheological properties, resistance to high temperatures, salinity and pH, and with such high stability may allow these polymers to be used in the oil industry as mobility controllers and emulsifying agents. Perhaps one the more interesting facets of research into halophiles has been in the various applications to the environment—not only in bioremediation but also in the production of more ecologically acceptable materials. *Haloferax mediterranei* may be used to produce bioplastics which are readily biodegradable in the environment. Other organisms may be used in the cleaning up of oil spills by reducing the surface tension of the oils and tars in the crude oil. This ability is a result of the unique membrane lipid composition of extreme halophiles. Parts of the cells of halophiles, *e.g.* DNA, plasmids and proteins, are also finding uses in the medical diagnostics field. Also the cloning of structural and regulatory genes responsible for the synthesis of solutes compatible with both the internal and external cellular environments (and thereby increasing salt tolerance) is a possibility for the future, allowing crops to be grown where it is currently not feasible—approximately 36% of the Earth's available arable land is affected by elevated salt concentrations. Many of these microbes have the capacity to accumulate heavy metals and radionuclides which may be exploited to remove potential toxicity from aqueous effluents, thus allowing for their safe discharge. The same process could be used to reclaim valuable metals and reduce effluent toxicity (Herbert, 1992).

From acid to alkali—life across the range. High concentrations of protons, as well as low concentrations, are toxic to most micro-organisms. Just as salt is used as a preservative, so also acidic conditions are employed by man to help preserve various foods from decay *e.g.* yoghurt and cheese (lactic acid) and pickles (acetic acid). Although bacteria are used in producing these acids in the food, the fermentations usually continue to such an extent that eventually the acid conditions, together with nutrient limitation, kill the bacteria. In the environment there are naturally occurring areas that are acidic, as well as the microbes themselves producing acidic conditions. Acidophiles benefit from or create the acidity of their environment, with some growing at pH 1–2; they fail to grow at pH 6 or higher. *Thiobacillus thiooxidans* has a pH range 0.5–6.0. A key feature of these organisms is that they oxidise reduced sulphur compounds, under aerobic conditions, to sulphuric acid and derive energy from the reaction in the process. As a consequence of this formation of acid, a strong oxidising liquor develops. This ability has been exploited commercially for the extraction of metals from pyritic ores, as the liquor can be used to solubilise heavy metal ions. This microbial leaching currently makes up 10% of the world copper production and has also been employed in the extraction of uranium from low grade ore. As high grade ores become increasingly scarce and energy consumption needs to be cut back, the attractiveness of biomining is increasing. *Sulfobolus acidocaldarius* is a thermoacidophile that may be used to reduce the sulphur content of coal (implicated as a causative agent of 'acid rain') at higher temperatures (and hence reduced cooling costs), cell and coal concentrations, than is possible with other microbes. In many ways, it is appearing that God has provided the means for us to use the materials in the earth without destroying it. He has provided ways for the things we need to be obtained, whilst still being obedient to the command to care for all creation and to manage it. Our wise Creator has even included solutions to help put right some of our mistakes.

Alkaliphiles are organisms that are incapable of growing at neutrality and generally they have their optimum at about pH 9.5. The naturally alkaline areas are alkaline ground waters, soda lakes and deserts as well as man-made environments resulting from the effluents of *e.g.* cement manufacture, electroplating processes and others. Alkaliphiles provide us with many of the enzymes used in detergents. One of the many possible future applications of the enzymes of these organisms is in waste-water treatment systems. Alkaliphiles also have demonstrated that they can produce novel antibiotics with a broad spectrum of activities (Herbert, 1992).

Bacteria with Magnetic Attraction

Magnetotactic bacteria are a small group of bacteria with the amazing property of being 'living compasses'. These bacteria are microaerophilic (they require oxygen but only at a low level—lower than normal atmospheric concentrations) and therefore need to find such an environment before they are poisoned by excess oxygen. This microaerobic zone may exist in sediment or occasionally in the water column where there is upward diffusion of, for example, hydrogen sulphide, generated from bacterial sulphate reduction in the sediment, but generally this low oxygen zone is in or near the bottom sediment. *Aquaspirillum magnetotacticum* is one of these bacterial compasses and is magnetotactic because of enveloped magnetite particles called magnetosomes (Bazylinski *et al.*, 1993). (See figure 2). These magnetosomes



Main: Freshwater magnetic bacteria—note chains of electron-opaque magnetic particles *(a)* bound to the magnetosome mambrane
Close-up: Magnetosome membrane *(m)* covering the darker magnetite particle *(p)*

Fig. 2: Magnetoactic bacteria

are often arranged in chains with a magnetic dipole moment (each crystal adds its moment) strong enough for cells to behave like compass needles—detecting geomagnetic gradients (Guerin *et al.*, 1992). There are even two types of alignment —north-seeking and south-seeking, producing bacteria that will swim north or south respectively. The Earth's geomagnetic field contains a significant vertical component at most latitudes and it is this factor which is exploited by magnetosomes; north-seeking bacteria will swim downwards in the northern hemisphere and upwards to the water surface in the southern hemisphere—the opposite is the case for south-seeking bacteria. The downward direction is most advantageous for microaerophilic bacteria, because it is where the organism is most likely to find its optimal redox environment—in the sediment. The magnetosomes are also interesting in that the membrane which encloses the magnetite or greigite particles, inhibits the aggregation of the particles into globular mass and instead allows the alignment and formation of a chain of usually 10–20 particles (Matsunaga, 1991). God has left nothing to chance but has created each of his creatures perfectly for their part in the created order. Man has also discovered the compass and used it to direct his travels but perhaps yet not as sophisticated or as compactly sensitive as the Creator's little compass.

Fungal Ballistics

The fungal genus *Pilobolus* is part of a group of fungi that discharge their spores in a particularly violent but ingenious manner. Basically the sporangium sits on top of a large vesicle which has at its base a band of carotene rich cytoplasm (see figure 3). When light falls on the sporangium it is focused by the vesicle to the carotene rich band. At this band some stimulus is transmitted to the cylindrical part of the sporangiophore resulting in more rapid growth on the side away from the light. Curvature of the whole sporangiophore thus occurs until it is oriented symmetrically with respect to the light. The vesicle is quite turgid, containing water under pressure of about 5.5 bars. The vesicle usually explodes about midday and due to the elasticity of the vesicle wall the liquid contents are squirted out, projecting the entire sporangium forwards in the direction of the light. Photographs of the jet of liquid show that it is at first cylindrical but eventually breaks up. The velocity of projection varies widely , with a top speed of 27.5 ms^{-1} (over 60mph), although 10–11 ms^{-1} is average. The sporangium can be projected vertically upwards for as much as 2.0 m and horizontally for 2.5 m. This way the spores are widely dispersed to land on vegetation that will be consumed and so repeat the life cycle again after passage through an animal gut (Webster, 1980). It would appear that man has only been too eager to copy this method of dispersal for altogether different purposes, not to spread life but the reverse. Man's creative ability is evident as is his sin.

Fighting Big Bugs with Little Bugs

Biological control has become a very popular thing in the past few years, especially with 'organic' methods of farming, *etc. Bacillus thuringiensis (Bt)* is a well known pathogen of lepidopterous larvæ. Similar products, which make *Bt* pathogenic to lepidopterans have also been found to be toxic for *Diptera* (mosquitoes and other flies) and *Coleoptera* (beetles) which can be pests on various food crops and forest trees (Lynch *et al.*, 1992). The mechanism of toxicity works like this: the bacterial spore coat contains the toxin; larvæ feed on small particulate matter which includes spores of *Bt.* On ingestion of the spores, the crystal protein (the toxin) dissolves in the high pH of the gut. Proteolytic action of gut enzymes releases toxic fragments which then enter the epithelial cells lining the gut. These cells swell and lyse. Disruption of the epithelial lining rapidly kills the larva (Priest, 1992). The toxin acts by binding to specific receptors on the plasma

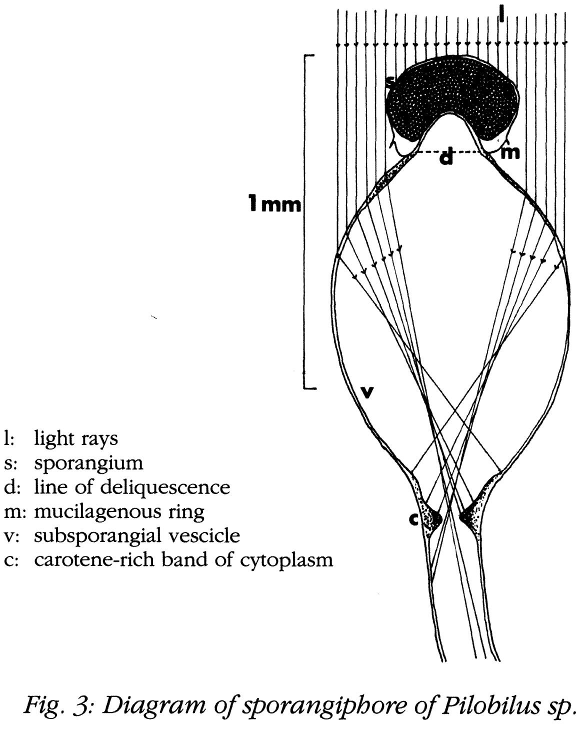


Fig. 3: Diagram of sporangiphore of Pilobilus sp.

membrane and initial binding is followed by the creation of small pores in the membrane. Subsequent equilibration of ions across the pores leads to a net influx of ions and an accompanying influx of water, cell swelling and lysis. *Bt* toxin has a potency—approximately 300 to 80,000 times more than currently used pesticides, with the added advantage that intoxicated larvæ quickly stop feeding and do eventually die (Feitelson *et al.*, 1992). A still smaller control agent is the baculoviridæ—viruses that only occur in invertebrates. These viruses have high pathogenicity, narrow host range and complete safety to vertebrates and plants. With genetic engineering it is hoped that a foreign gene (coding for a protein toxic to the invertebrate host) might be inserted into the virus genome and so make a more pathogenic recombinant virus. Two viruses that have been produced have expressed insect-specific neurotoxingenes from a mite and a scorpion.

We have considered a variety of micro-organisms, many of them invisible to the naked eye, others from very extreme environments. In each we have seen the mark of intelligent design, whether in morphology and associated function or in the biochemistry which equips the organism to inhabit an environment which little else can tolerate. For each condition, for each function, the solution shows careful and ingenious design. Far from being seen as the product of continual increase in complexity over long periods of time, complexity is seen alike across a range of organisms both 'primitive' and more 'advanced'. In a world where God is Creator, we cannot believe that anything that has been made has been made by chance—all must have a purpose. From Scripture we must assume that God never intended man to leave his intellect and creative ability unused. God must have meant man to discover microbes and put them to work in his task of caring for and exploration of the world. In many ways it is only to be expected that man should copy principles and ideas that he finds in the world around him and then apply them creatively in a different way to something apparently quite unrelated. It is a mark of man's own creation in the image of God that he should do such things.

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[*Editorial footnote:* A recent report underlines the author's comments on flagellar motion. Y. Magariyama *et al.* (Nature, 1994, 371 (27 Oct.): 752) report that *Vibrio alginolyticus* has a remarkable flagellar rotation of 1,700 r.p.s.]

The Bible and Chronology

1: The Historical Time Frame

J. H. John Peet

THE IMPORTANCE of chronology to biblical interpretation is almost self-evident. It is frequently important in order to determine the cultural context, and so understanding, of a biblical passage. Often it is important in order to resolve apparent conflicts between the biblical account of an event and that in some secular interpretation. If we are looking for a non-biblical record of an event, we have to know the time context so that we look in the right place.

For the biblical creationists, chronological studies have an obvious implication. Battle often rages over the age of the earth and whether it can be predicted from the genealogical data. How do we relate archæological and geological data to the biblical revelation? As biblical creationists, we are aware of the historical nature of the Genesis record. Not only do the early chapters lack poetic structure, but they are presented in historical form and context.

Moving into the later historical books of the Scriptures in order to recognize Hebrew historical form, we see that such passages open with the form 'In the days of X, king of Y, …' Sometimes it will refer to the local ruler or one of another country. On other occasions it may refer to another official. For example, Mark 6:26 dates an event to 'When Abiathar was High Priest'.[1] Another event, the birth of Christ, was 'in the days of Herod the king' (Matthew 2:1) and also 'in those days … [of] … Cæsar Augustus' (Luke 2:1). Returning to the Old Testament for an example, 'In the eighteenth year of king Jeroboam, the son of Nebat, [king of Israel], Abijam began to reign in Judah'. (1 Kings 15:1). We note too, from this latter reference, the genealogical data, emphasising the reality. Again, in Luke 3, we read of the age of our Lord when He began His ministry and of His genealogical details.

Turning back to the early Genesis record, we find many such features. The chronological context is fixed, 'In the beginning …' (Genesis 1:1) There are the genealogical details and special time frames (first day, *etc.* and the ages of the early men). Indeed, one might well ask what significance there was to this data if it were not meant to be chronological.

Genesis as history

Often scholars try to conclude that Genesis 1–11 is pre-history and not written as history, in contrast to the passages from Genesis 12 (from the story of Abraham). Aside from the fact that there is no change in the structure of the narrative, it still reads as prose, the two sections being clearly related by the historical record. The structure of Genesis is clear.[2] We are given the family of a person (*e.g.* Adam) in two parts. The first part is of the non-covenant children (*e.g.* Cain, Genesis 4:17–24), often including historical information, and then of the covenant line (*e.g.* Seth, Genesis 5:3–32), which usually lacks historical detail but leads straight on into the continuing covenant history. The last passage quoted ends with Noah's family. Genesis 10 picks up on this genealogy, again dealing with the non-covenant children, Japheth and Ham (Genesis 10:1-20) and then Seth (Genesis 10:21–31). Even here there is a notable feature. Eber has two sons, Joktan and Peleg. The former (father of the Arabian nations) is covered in this passage. It includes an interesting historical footnote on Peleg (Genesis 10:25), but the family of Shem through Peleg is the theme of the next chapter (11:10–32). We note that this climaxes in the family of Terah (27-28), before moving on to Abram, from whom the subsequent history flows. It is also noticeable that the members of the covenant family (before and after this point) are given with historical data (ages).

So, we believe that the early chapters of Genesis are history. Further evidence can be deduced from the use of these passages by our Lord and His apostles. We note, as examples, our Lord's references to such characters as Noah and Lot with historical forms, 'In the days of Noah …' (Matthew 24:37) and 'In the days of Lot …' (Luke 17:28).[3] Also, much of our salvation doctrine is built on these chapters (the origin of sin, the promised Saviour as the last Adam), as are practical issues such as marriage and the use of the Sabbath.

Though the date of Creation is not important of itself, the data must be historically meaningful and reliable. In this short series, we will consider the importance of biblical chronology, how far we can go to reconstruct a historical framework for the early world and how the biblical data relates to the rest of ancient history.

Opposition to a historical structure

Though, perhaps, the above arguments seem self-evident, it is clear that there are many who treat the biblical

Cenozoic era	Pleistocene	Ice age	Genesis 12 +
	Tertiary	Continental division; 2nd major orogeny	Genesis 10-11
Mesozoic era	Cretaceous	1st major orogeny; regeneration of plants and animals	Genesis 9
Palæozoic era	Cambrian—Carboniferous	The Flood; obliteration of animal and bird life	Genesis 7–8

Figure 1: an abbreviated table relating the geological periods to the Scriptural passages.

data as fictitious to some degree. Probably the most notable recent critic was Professor Thompson who denied the historicity of many of the biblical events, not only before Abraham, but from Abraham through to Solomon at least (Thompson, 1994). It was part of his thesis that characters like Abraham and David do not exist in archæology. One is forced to ask why the Bible is not part of this archæological record. Does it have to be dug up from the dust after thousands of years in order to qualify?

Why should one expect to find Abraham recorded in the writings of other countries? There are plenty of characters of his time that are not known outside of their local city-state records.[4] On the denial of the historicity of David, we are reminded of how the critics denied the historicity of Daniel because it contained an otherwise unknown Chaldean king, Belshazzar. He has since been found in the Babylonian records.[5] Similarly, after Thompson's pronouncements (and he speaks for many), we read of an inscription referring to the 'house of David' (Biran and Naveh,1993).[6]

Many of the apparent conflicts end up in a disparaging of the Scriptural record. It is not unusual to be told that something (typically, the Exodus and Conquest) does not accord with Egyptian or some other record. The implication (and often the stated conclusion) is that the Bible writers got it wrong. But, even leaving aside divine inspiration, why should the Bible writers, rather than the Egyptian scribes, be wrong?

There is also the interpretative element to consider. While this does apply to Scripture, it is less of a problem because of its inerrancy and because the biblical languages are better understood. With, say, the Egyptian records, we are faced with the problems of unknown languages, partial records and, sometimes, questionable accuracy (aside from natural mistakes, records can be biased or fraudulent).

The same problems, but accentuated, apply to the non-written archæological data. How do we interpret our discoveries of pots and tools? What is our absolute standard? Often 'biblical archæologists' will tell us that there is no evidence for the Exodus or for the Conquest of Canaan. We will consider this again in the third article, but it is worth noting that the data on Jericho has been re-evaluated and shown to be in agreement with Scripture (Wood,1990) and that Livingston has claimed that the conventional site for Ai (Livingston, 1971) does not accord with the biblical record and could be located elsewhere. Unfortunately, many place greater reliance on the archæological arguments (the result of human logic) than on Scriptural statements (divine revelation).

Geology and chronology

The relationship of geology to chronology has been highlighted by Michael Garton (Garton, 1991). If the geological framework suggested by that author is essentially correct, and we believe it is, then geological and archæological times overlap. We see from the writings of Garton and others that the geological—historical time-frame is approximately as listed in figure 1. (Different writers will offer different details, but this figure summarises the essence of their work).

It is seen that the post-Flood period must be integrated into the conventional archæological time-scale. So, the Mesozoic/Cenozoic periods cover the time after the Flood year up to the time of the patriarchs (Genesis 10-11). This period probably includes the time of Job.[7] It is important to remember that creationists do not see any relationship between the geological column (Palæozoic—Cenozoic) and creation. Creation speaks of life, harmony and the 'very good' (Genesis 1:31). The geological column speaks of death, distress, destruction and is consistent with the judgment (Genesis 7–8).

A further consequence of this relationship is that we can ask how we can relate the archæology of, say, Palestine or Egypt, to the geological framework we are proposing.

In the next part of our series, we will examine biblical chronology in more detail to see what 'fixed points' we have and what uncertainties there may be in it.

Notes

1. Note that Abiathar was referred to the chronological setting; 1 Samuel 21:1 tells us that the incident involved the priest, Ahimelech.
2. See also the work of Wiseman (1977) and Mackey *et al.* (1987).
3. It is interesting that miraculous events like the Flood (Noah), the destruction of Sodom and Gomorrah (Lot), the brass serpent (Moses) and the swallowing of Jonah become key features in the Lord's doctrinal teaching affecting salvation, the resurrection and His return—and yet are sacrificed on the altar of compromise by so many.
4. For the historical context of Abraham's day, see Millard and Wiseman, 1980.
5. The Babylonian Chronicle, which can be seen in the British Museum; also the Verse Account of Nabonidus.
6. For other comments, see Cryer, 1994; Davies, 1994; Millard, 1994; Rainey, 1994.
7. Job 38 is an interesting chapter. Verses 4f refer to Creation. Verse 8 appears to have the Flood in mind (*cf.* Genesis 7:11). Verses 29f could refer to the Ice Age (not a natural description of a Middle Eastern climate). If this is so, then the intermediate verses might be referring to the post-Flood stability. The unusual creatures of chapters 40 and 41 (behemoth and leviathan) would then fit in well with the dinosaurs.

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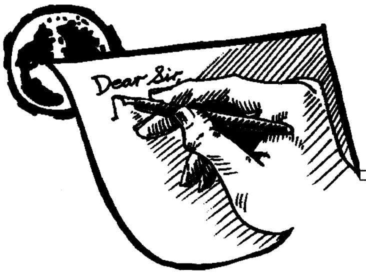


Correspondence

B. L. Watt

I continue to find the magazine and various notes that are produced of great help, for which I give thanks to you and those who produce the articles.

Margaret B Anderson

The article *A Biblical Look at Early Civilisation* by Jonathan Stephen was read onto an audio magazine by Torch Trust for the Blind. I found it very interesting.

Ray Trainer

Thanks ... to BCS for an excellent magazine.

Isabel McL

As you don't mind receiving comments—here are some more! I enjoy all the literature but I've particularly enjoyed Sylvia Baker's articles on vision, the article on hæmoglobin and Dr. De Groot's astronomical discourse. My only complaint is that there's too little!

Rapid Formation of Calcium Carbonate Concretions in a North Norfolk Marsh

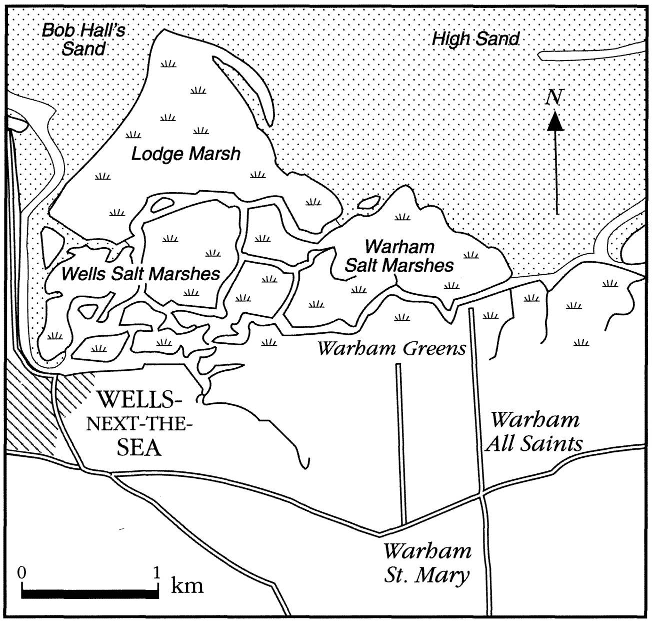
Paul Garner

ON WEDNESDAY 5th October 1994, the *Eastern Daily Press* carried a remarkable story headlined 'Magic in the marsh: amazing geological find of mud turning to stone'. The article claimed that scientists were astonished by the speed at which calcium carbonate concretions—irregular or rounded lumps of rock—were forming in sediments in a Norfolk salt marsh.

To understand the significance of these observations, we need to know a little about what happens to a sediment after it has been laid down. After clays, muds, or sands are deposited, they undergo a variety of processes which are collectively called diagenesis. In simple terms, diagenetic processes are the changes which take place in sediments which ultimately lead to them becoming sedimentary rock. During diagenesis some constituents of sediments have a tendency to concentrate in certain parts of the incipient rock, and may form hard masses which geologists call concretions. Such nodules are fairly common in the geological record. It is usually assumed that diagenetic processes take very long periods of time—modelled growth rates for carbonate concretions imply that their formation may take more than 100,000 years (Berner, 1968).

However, creationists who hold to the young-earth model do not have 100,000 years of earth history to play with! If the major sedimentary rock formations of our planet have been deposited very recently, perhaps in the last 5,000–6,000 years, diagenetic processes—such as concretion growth —must have taken place much more rapidly than geologists usually assume. The data on concretion growth in sediments near Warham on the north Norfolk coast provide clear evidence that these processes can occur in very short time spans, just as creationists have suspected. More technical information to that provided in the *Eastern Daily Press* article is available in scientific papers on these concretions published in *Marine Geology, Nature* and *Sedimentology* (Pye, 1981; Pye, 1984; Pye *et al.*, 1990; Coleman *et al.*, 1993). Several further papers are in preparation (Kenneth Pye, personal communication, 1994).

The Warham intertidal marsh and sandflat sediments are known to have been deposited since the Second World War, and are therefore less than 50 years old, yet they contain concretions up to 0.4 metres in diameter (Pye *et al.*, 1990). It is clear from descriptions of these nodules that they have formed *in situ* in the marsh sediments—for instance, laminations have been traced through some concretions into the surrounding sediment. In some places continuous cemented layers 15–25 centimetres thick can be traced laterally for 3 or 4 metres (Pye, 1981).



Many of the Norfolk concretions contain intact and broken shells, and plant remains, and may help geologists to interpret similar fossil-bearing concretions in the geological record. Fossiliferous concretions are known from many localities—for instance, the Santana Formation of Brazil (Martill, 1988; 1989) and the Francis Creek Shale of Illinois (Baird *et al.*, 1986; Maples, 1986; Schopf, 1979; Woodland and Stenstrom, 1979). The beautiful preservation of fossils in these ancient concretions should have already caused us to question the long time spans normally assumed for concretion growth.

In fact, as creationists have pointed out, there is an increasing weight of evidence that cementation of sediments can proceed very rapidly indeed. Rapid lithification is known to have occurred in modern times on the ocean bottom, on reefs, on beaches (beachrock), in backshore sand dunes (æolinite), and in freshwater rivers and springs (cayrock). Rapid lithification of marine sediments has been documented at the volcanic island of Surtsey (Alexandersson, 1970). A cannon, a battery, barbed wire, tin cans, beer bottles, and Coca-Cola bottles have all been found embedded in solid 'limestone'. Beachrock formation takes place in nature in only a few weeks, and can be reproduced in the laboratory in hours (Wise, 1986). The term marshrock has been proposed for the Warham cemented sediments by analogy with beachrock (Pye, 1981).

The rapid growth of concretions on the north Norfolk coast adds to the accumulating evidence that the young-earth creationist time scale is not necessarily an unreasonable one, and also highlights how little is actually known concerning the processes and rates of cementation of sediments. Diagenesis is likely to be a fruitful area for further study by creationists.

Acknowledgements

I would like to thank Mike Sockolov for bringing the article in the *Eastern Daily Press* to my attention, and Professor Kenneth Pye of the Postgraduate Research Institute for Sedimentology at The University of Reading for kindly sending me reprints of his papers on the north Norfolk concretions.

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GENESIS AGENDUM

A new Creationist project has recently been launched. It is not competing with existing UK organisations but complementing them. The objective is to help people in their thinking about the origins of the world. The name has been adapted as an umbrella title to cover a range of projects such as publishing, video production, exhibitions and conferences. But the big dream of the originators (sorry, no pun meant!) is to found a Museum of Creation and Earth History in London, hopefully in the South Kensington area!

Such a project demands much, much prayer and a lot of money. Though this is not a BCS project, we do commend it to our members as worthy of consideration for prayer support. (See our editorial on the need for this). If you are interested in receiving more details, contact Sean McCormack at 34 Calvert Road, Greenwich, London SE10 0DF. If you want a full report, please send a stamped and self-addressed A5 envelope to Sean.

The Earth's Early Atmosphere

J. H. John Peet

ONCE the concept of the 'evolution of species' was accepted by most of the scientific community and its atheistic (or agnostic) principle was considered as 'beyond reasonable doubt' (though we dispute this), it was inevitable (and, indeed, necessary) that this was extrapolated back to the 'origin of life' itself. Of course, this also requires a mechanistic definition of life. Just as Darwin looked for his evidence in the fossil record, so the modern evolutionist looks for his evidence in the chemistry laboratory.

A lot of dramatic claims have been made on this front, but this is a 'fool's paradise' (Peet, 1982). The largest chemical laboratory (accepting the evolutionist's presuppositions) is the early earth. Does this back the evolutionist's claims?

The crucial phase in the chemical evolution is the very first one: the preparation of chemicals from which life supposedly 'spontaneously' arose. The evolutionary scenario requires that the initial conditions involved simple chemical species and then these were converted to more complex materials. The accepted dogma is that the primitive atmosphere was 'chemically reducing'. Essentially, this means an absence of oxygen or substances that can act as a ready source of oxygen. This is *fundamental*, because the chemicals of life deteriorate in an oxidising atmosphere ('John Brown's body lies a-mouldering in the grave'!) Only living systems can counter this. Figure 1 shows a typical projection of the amount of oxygen in the pre-biotic atmosphere.

If a reducing atmosphere (or, indeed, an oxidising one) existed, it should be demonstrated in the rocks. They will be affected by the environment. By looking at the mineral content of early rocks, we will demonstrate that the atmosphere was oxidising rather than reducing.

The famous experiment by Miller is still hailed as a triumph for evolutionary theory, but it is totally irrelevant unless a reducing atmosphere did exist. The principle of his experiment was basically as shown (figure 2). Incidentally, there is nothing magical about Miller finding amino acids in his flask: what else would one expect to find? But, is it relevant?

This scenario is so universally accepted, that Maddox said, on the BBC radio, 'After more than a decade of speculation, it's now clear that when life began the atmosphere of the earth was rich in materials such as methane, ammonia, hydrogen and water vapour'.

At the same time, Henderson-Sellers wrote that this popular view stems 'as much from ignorance of recent advances as from active opposition'. Who's right?

A standard evolutionary picture is given in figure 3. It will be observed from this diagram that the Banded Iron Formations (BIF) are conceived as being formed during the period of conversion from a reducing to an oxidising atmosphere. The classic examples of minerals quoted as being formed in the fully reducing atmosphere are pyrite and uraninite (FeS_2 and U_3O_8). (We are using the accepted geological dates which are based on radiometric methods, but this does not imply our acceptance of them).

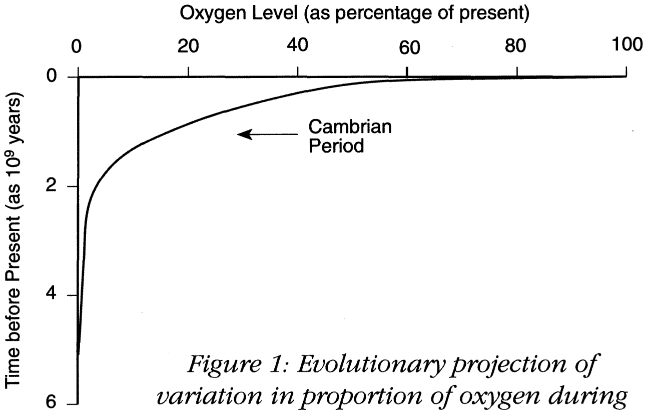

Figure 1: Evolutionary projection of variation in proportion of oxygen during earth history

It would be useful to clarify our method of ascribing the degree of oxidation of an element. We use a scale of 'oxidation numbers' (or 'states'). For example, for iron and uranium:

Fe	0	+2	+3		+6
increasing extent of oxidation →					
U	0		+3	+4	+6

The zero state refers to the metal. The higher states indicate the extent to which oxidation has occurred. In normal atmospheric conditions, iron exists in the +3 state (called 'ferric') as typified by rust. The lower state is easily formed but won't exist in an aqueous medium under normal atmospheric conditions: a reducing environment is essential. (Reducing implies a lowering of the oxidation state). The highest state, +6, can only be formed under extreme conditions. So, if we find ferrous minerals, we conclude that a reducing environment existed. In the same way, uranium exists in the +6 state under normal atmospheric conditions. The +4 state requires reducing conditions. So, uranium(+4) indicates a reducing environment existed. The oxidation state is usually denoted by Roman numerals, *viz.* uranium(IV).

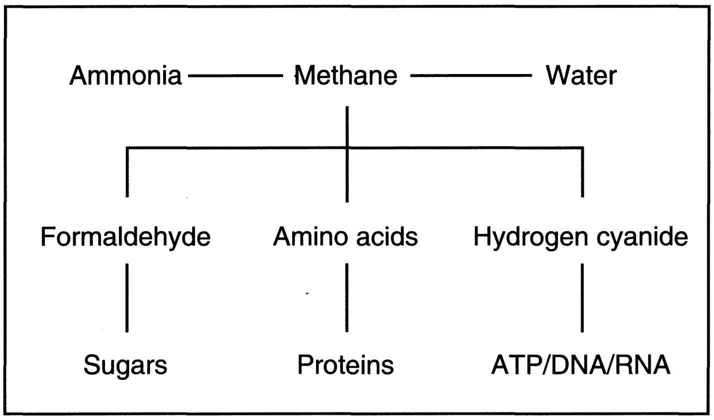

Figure 2: A summary of the evolutionary scenario for the origin of life

The chemical energy required to convert the element from one oxidation state to a lower one is called the reduction potential.

It is on this basis that the evolutionist has sought to justify his claims of abiogenesis in a reducing environment. Let us proceed further by looking at his evidence. We will consider each of the specialized rocks and other atmospheric features considered to be consistent with a reducing atmosphere and its gradual change to an oxidising one.

Banded Iron Formations

These are oxidised marine sediments containing alternately iron-rich and iron-depleted (silica) layers. Much of the iron is in the ferric state, implying the presence of oxygen.

Under a reducing atmosphere, the iron would pass into solution as ferrous iron. It would not undergo further oxidation because of the absence of oxygen, but would react with the carbon dioxide in solution (a high partial pressure of CO_2 is assumed) to deposit iron(II) carbonate (siderite).

However, there is little iron(II) present! Most of the iron is in the +3 form as the oxide hæmatite, a 'dried out rust'. So, the evidence for ferrous iron (certainly in significant quantities) is more by implication than fact.

The evolutionist links this with the supposed evolution of oxygen-producing species at this time. The iron(II) is presumed to have acted as a sink to 'mop up' this oxygen excess until the iron(II) was exhausted and oxygen-mediating enzymes appeared on the scene. But this is a circular argument: it depends on the supposed formation of iron(II) for which there is no evidence.

Red Beds

These are deposits of sedimentary rocks, such as sandstones and shales, stained with red hæmatite, normally occurring in higher strata than the BIFs.

Once oxygen accumulated in the atmosphere, according to the evolutionary scenario, all reduced species on land were oxidised. So, red hæmatite (iron(III) oxide) was now exclusively deposited.

What can we say to all this evidence? Dimroth and Kimberley (1976) effectively destroyed it, though it is still quoted. For example, the 'oxidised' red beds do not always occur in the later oxidized formations. It should be noted that the red beds and BIFs are found in strata of similar age and even in reversed order. As Dimroth and Kimberley put it, 'The suggestion ... that the thick Middle Precambrian iron formations pre-date red-bed sedimentation and mark the initiation of an oxygenic atmosphere is demonstrably incorrect ..'.

Furthermore, the differences in the Precambrian and Phanerozoic iron formations are generally in degree rather than in kind. The same authors judge that 'it is commonly assumed *a priori* that other sedimentary rocks ... clearly indicate contemporaneous lack of atmospheric oxygen'.

Such an assumption is invalid. There is no evidence from the iron deposits for a change in the atmosphere.

Recently, Tsu-Ming Han found some coiled spiral fossils of eukaryotic algæ in the middle of iron-rich layers of rock in an iron mine in Michigan. Their presence also casts doubt on the claims of a non-reducing atmosphere at this time. In Western Australia, another fossil plant has been found in Precambrian rocks. Again this demonstrates that oxygen was around far sooner than previously thought.

Magnetite

So, how do we account for the formation of magnetite which contains at least some iron in the lower oxidation state? A relevant question to ask is whether iron(II) is formed under modern geological conditions. Van Houten has reported that ferric iron is transported in tropical weathering products, it is then readily reduced by decaying organic matter in shallowly buried, anoxygenic sediment. The only reason to ignore this is the *a priori* assumption that such organic matter had not yet been evolved or created. (Alternative chemical reductions are also possible and are mentioned below.)

Pyrite

Pyrite is a sulphide of ferrous iron. If the evolutionary hypothesis is correct, it should be a consistent component of all fluvial and shallow-marine sandstones deposited in the proposed anoxic conditions. To account for its absence from substantial Proterozoic and Archæan sandstones, evolutionists propose it underwent oxidative corrosion leading to its solution and transport. Again, the evolutionary scenario assumes that iron(II) *must* have been present because of the presumed reducing atmosphere; it would then be oxidised to iron(III).

A better explanation would be its accumulation at selective sites because of *local* reducing conditions. Significantly, it has been found in *modern* alluvial sediments and does not require a reducing atmosphere. The oxidised forms can be reduced by any chemical with a larger reduction potential (subject to certain secondary controls). For example, iron(III) is readily reduced by sulphides to the iron(II) state. The existence of sulphide in pyrite indicates that iron(III) *was* present. So, iron(II) is the result of iron(III), not *vice versa* as normally supposed. (There should be other possible reducing agents that one could consider too; most metals, for example, would have such properties).

Uraninite

This mineral is composed of uranium in the mixed oxidation states, +4 and +6. Again, as for magnetite, it has been shown that it is deposited under modern conditions (*e.g.* in the Indus River), so it does not imply the presence of a reducing atmosphere.

How then do these oxidisable species arise? Undoubtedly by biological or chemical weathering. The former has already been mentioned in connection with BIFs. It is significant, as pointed out by Dimroth and Kimberley, that 'Stratiform ores of uranium ... with over 300 times mean crustal abundance, are also generally richer in carbonaceous matter than unmineralised sandstones and conglomerates'.

This supports the theory of biological origin.

Sulphur minerals

Early evaporites contain much calcium sulphate and these continued to form in the Precambrian and the Phanerozoic, with apparently little change in the rate of formation. The sea, then, must have been saturated with calcium sulphate from early times, as it still is today. The calcium ions were, no doubt, derived from the mantle, but what was the source of sulphate?

The formation of pyrite near volcanic vents could be postulated in a reducing environment. The production of metal sulphides by the effect of volcanic hydrogen sulphide on metal salts in aqueous solution sounds feasible, but, in fact, it has been shown to be improbable.

Sulphur in Recent deposits is apparently formed by the action of reducing bacteria and is closely associated with bituminous shales. This would also adequately account for the primordial sources of sulphides (Clemmey & Badham, 1982). Volcanoes liberate hydrogen sulphide and sulphur dioxide, which seem to have been the only sources of sulphur. The sulphur volatiles might have been oxidised to sulphate by free oxygen or perhaps by photochemical

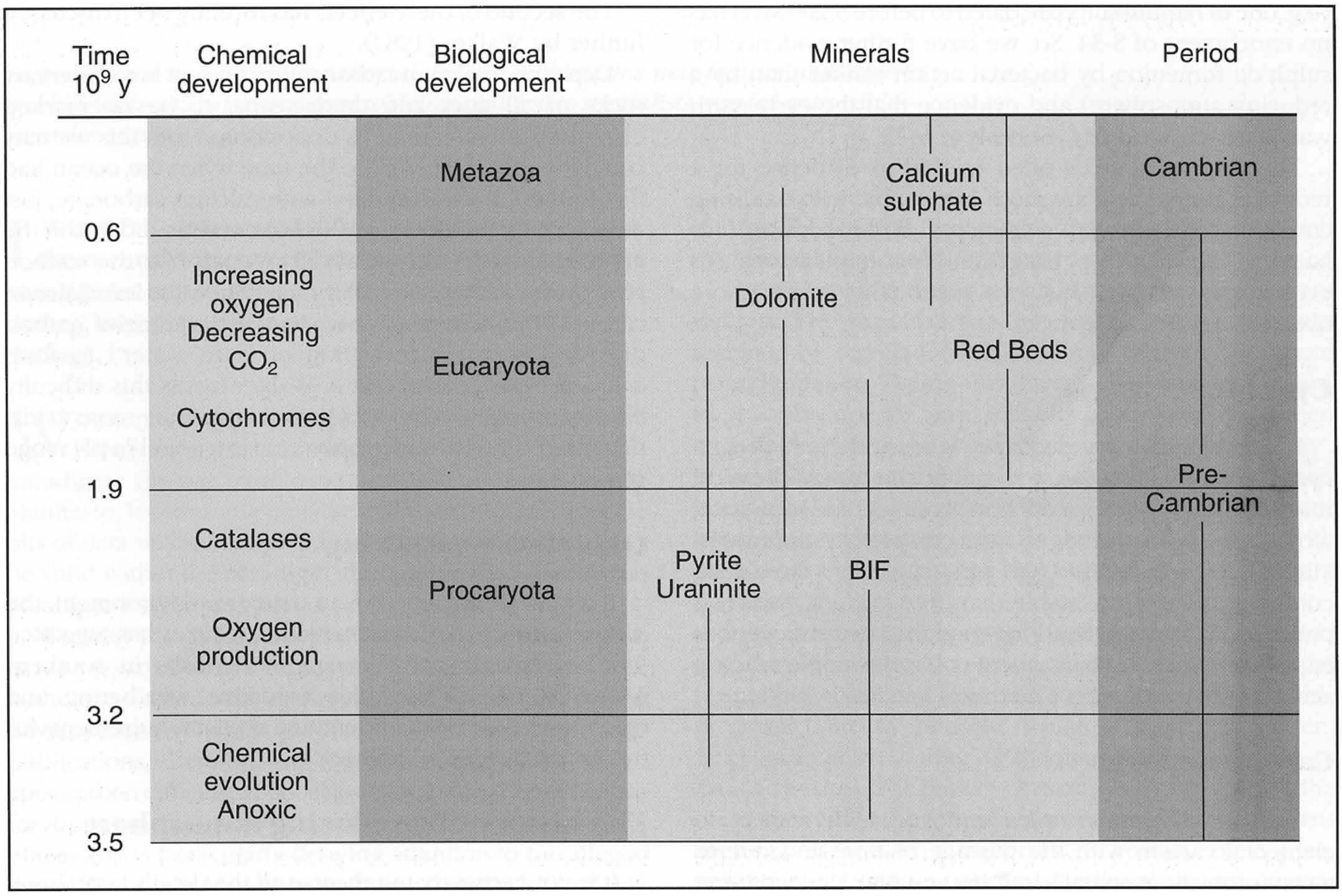

Figure 3: Evolutionary interpretation of the geological record

reactions, the oxygen being derived from water. *Bacterial action* would produce metal sulphides (such as pyrite) and oxygen. The occurrence of Archæan bedded sulphate in a number of places is then consistent with an oxidising atmosphere. Walker (1982) notes that sulphur must have been present as sulphate in Archæan oceans, and so the sulphide concentration must have been low.

There is an interesting corollary to the sulphate problem published in another paper. Cameron has analysed various deposits of calcium sulphate. The element sulphur contains the isotopes S-32 and S-34. Separation of the sulphurs takes place biologically when sulphate-reducing bacteria reduce sulphate to hydrogen sulphide. The sulphides to which this gives rise are depleted in S-34 to the extent of up to 3% and such sulphides, formed in the early oceans, date back 2,300 million years (Myr). (We would note that this requires the existence of reducing bacteria and an oxidising atmosphere at an early stage of the earth's history, requirements which impose increased restrictions on the proposed evolutionary scenario!)

When calcium sulphate is precipitated from water, the ratio of the isotopic sulphurs is unchanged. In cases where a solid evaporite was formed by evaporation, it is enriched in S-34; the oldest known evaporite (with a 1.75% enrichment) is dated at about 1,300 Myr. This selection implies bacterial differentiation as evaporation alone does not produce such an enrichment. Earlier layers of sulphate (*e.g.* one of barium sulphate dated to before 3,200 Myr) has no enrichment of S-34. So, we have further evidence for sulphide formation by bacterial action (rather than by a reducing atmosphere) and evidence that the early earth was water-covered (*c.f.* Genesis 1: 6–7).

The mineral sources often quoted as evidence for a reducing atmosphere are more compatible with oxidising conditions. Substantial evidence can be adduced for bacterial action. This has disturbing implications for evolutionary theory. But, we must take a few more observations from the rocks.

Cyanide

If the evolutionary scenario is true, then hydrogen cyanide was formed as a result of the 'great chemical reaction' (see figure 1). Now iron, in either oxidation state, would react with cyanide to form complex cyanoferrates. Minerals of this family (*e.g.* 'prussian blue') should be common, being more stable than free cyanide, which is presumed to have survived long enough to form nitrogenous bases, the necessary constituents of, for example, nucleic acids. Evidence of such a chemical species is lacking.

Carbon deposits

Organic carbon becomes enriched with respect to elemental carbon with the passage of time and due to metamorphism, eventually forming graphite. Under present day conditions, only 1% of such carbon survives oxidation. Anoxic conditions should cause *most* of it to survive. However, this does not fit the facts. An oxidative atmosphere is again implied.

Temperature of the planet

It is a wonderful fact, according to the evolutionary postulate, that over thousands of millions of years, the temperature of the earth has changed very little indeed. Had it have been otherwise, our earth could never have provided a haven for life in the universe, for either it would have become ice-bound (as did Mars) or over-heated (as did Venus) and recovery from either state appears to be impossible, at least beyond the very earliest stages. How has this remarkable thermostatting effect been achieved, seeing that when the earth was young, the sun was a good deal cooler than it is today?

There are two possible explanations based on uniformitarian principles and we may suppose that both have played an important part. First, there is radioactivity: radioactive isotopes of such elements as potassium and uranium were at one time more abundant than they are today and must have generated much heat. Secondly, it is possible, indeed likely, that carbon dioxide was more plentiful in the atmosphere than it is now and its greenhouse effect would have reduced the loss of heat which the earth received from the sun (Henderson-Sellers, 1980).

The second of these effects has recently been discussed further by Walker (1982).

Deposits of calcium carbonate are present in sedimentary rocks of all ages and there seems to be no marked deviations in the rate of its deposition. From this we may conclude that right back to the time when the ocean had first formed, it was saturated with calcium carbonate, just as it is today. But how was this so, if carbon dioxide in the atmosphere was so plentiful? Would not the carbon dioxide have kept the carbonate in solution? Calcium carbonate dissolves in water in the presence of carbon dioxide (as in the formation of 'hard water') to form calcium hydrogencarbonate. Walker meets this difficulty by suggesting that the ocean was at one time more acidic than it is today—his calculations cover a possible pH range of 6 to 8.

Oxidative weathering

If a mineral is formed in an oxidative environment, the surface consists of oxide formations. Clemmey has suggested that segregation within uranium deposits in southern Africa is indicative of this oxidative weathering and diagenesis. Dimroth has identified similar requirements for the Archæan basalts in Canada.

The history of a reducing atmosphere

It is not necessary to rehearse all the details here, but it has been shown that the ammonia would be removed by solution and by photolysis. In the latter case, it would be irreversibly converted to nitrogen in less than 40 years. Methane would be destroyed through photochemical reactions within 50 years. So, a reducing atmosphere is chemically unstable.

This same photochemical process could have resulted in the dissociation of water to produce oxygen at a level of at least 25% of the current value, so converting it to an oxidising atmosphere.

About 25 years ago Abelson proposed an oxidised atmosphere (rather than oxidising) based on carbon dioxide and water vapour. Henderson-Sellers *et al* have investigated the relationship of the earth's temperature to this oxidised atmosphere. Their conclusion is that this atmosphere is compatible with the earth's temperature history. This 'neutral atmosphere' (in terms of reducing/oxidising properties) has had increasing favour, as indicated above. However, there has not been any successful use of such conditions in simulation of the formation of prebiotic chemicals.

Conclusion

Abelson wrote, 'What is the evidence for a primitive methane-ammonia atmosphere on earth? The answer is that there is *no* evidence for it, but much against it' (His emphasis).

It is unlikely to have survived more than a few decades of the sun's activity and it inadequately accounts for several early evidences of an *oxidising* atmosphere.

The counter-proposal of an oxidised, but neutral environment is consistent with the earth's temperature history (assuming the uniformitarian approach), but requires an ocean of lower pH (which requires substantiation) and it still fails to account for positive evidences of an oxygenic atmosphere.

It is our submission that all the evidence points to, or is consistent with, an atmosphere which has always contained oxygen. Any interpretation of the geological record (whether based on an 'old earth' or a 'young earth') must be consistent with that fact.

Continued on page 24

Queries and Comments

As mentioned in a previous editorial, we are making this new feature available to enable readers to raise questions which we will put to specialists—as far as possible—in order to provide answers.

I WOULD be interested to know your comments on the recently discovered shin bone of the Boxgrove Man (dated at 500,000 years BP using palæomagnetic dating, which is semi-independent from radiometric dating).

We are grateful to the geologist who raised this point. Obviously he and we work within particular paradigms (in our case, a biblical one as stated in our Manifesto, for example) and we will each interpret specific bits of data within that paradigm. The interpretations may be valid within the paradigm, the question is whether the paradigm itself is correct.

We refer you to the paper by Roberts *et al.* (1994) which is, we presume, our friend's source of information too. The authors are wedded to the evolutionary paradigm for the development of man. As we have indicated in our publications, there are large gaps between men and the apes and it is difficult to conceive an evolutionary mechanism for bridging that gap. However, we presume that the questioner is particularly drawing attention to the alleged age of Boxgrove Man demonstrating that the biblical age proposals are inadequate to deal with this case.

Actually, we find the case inadequate in terms of such evidence. It is apparent (and stated plainly) that the dating of these remains (human tibia and stone tools) were indirect. The site itself was not dated, but the date was assigned by correlation with a site in Norfolk. We quote from the paper, 'Dating this interglacial/glacial cycle has, in the absence of any reliable absolute dates, been undertaken using correlative mammalian biostratigraphy'. In the next sentence, the authors make it plain that their interpretation of the data is based on the evolutionary transition of the water vole. There is nothing wrong with that in principle, provided one accepts the evolutionary paradigm.

Later in the same paragraph, as the questioner pointed out, they draw attention to the magnetic features of the sediments. Actually our correspondent answers this proposal correctly himself: 'which is semi-independent from radiometric dating'. Palæomagnetism does not of itself give dates. The pattern of reversals is correlated to the rock ages which have been determined by other means such as radiometric methods. (Though, of course, sedimentary rocks are only dated indirectly by radiometric methods anyway!)

The day this issue of Origins was being completed by the editor, a further paper was published on the date of Boxgrove man (Bowen, 1994; Roberts, 1994). Bowen and Sykes used amino acid isomerization techniques to determine a date of only 400,000 years for this human remain. This method is very unreliable, being sensitive to a range of variables. They consider Roberts correlation techniques to be unreliable too. Roberts, in his reply, actually makes matters worse by quoting a number of techniques which give even more variable ages, some below 200,000 years!

In passing, it was interesting to note that among the flint stones were examples of the Acheulian 'tools'. A recent paper pointed out that the pear-drop shaped Acheulian hand-axe is virtually unusable as a tool in the traditional sense (the sharpness of the edges on this circular tool would lacerate the hands severely) but it does operate very effectively as a discus-like weapon, downing an animal. It demonstrates yet again how skilled and intelligent these people were. Indeed, flint weapons themselves are very difficult to produce without a lot of skill and training.

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ROBERTS, M. B., STRINGER, C. B. and PARFITT, S. A. (1994), *A hominid tibia from Middle Pleistocene sediments at Boxgrove, U.K.* Nature, 369 (26 May): 311-313.

ROBERTS, M. B. (1994), *How old is Boxgrove man?* Nature, 371 (27 Oct.): 751.

CONCERNING design, examples like the Bombardier Beetle provoke the question, 'If this is God's original design, are we to accept that there were predators before the Fall? If it is post-Fall, are all the adaptions for predation and protection post-Fall changes? Was the woodpecker's structure originally only for making nesting sites in active living wood (or dead trees!)? Has it now been turned to seeking out insects only since the Fall? When was it designed?'

This is not an easy question to answer in that we are not told! Inevitably we are left with speculation, as we have said in the previous question, within our paradigm. There are peripheral factors which affect the answer to which again we don't know the answers. For example, though human death did not occur before the Fall and was a punishment for man's rebellion against his Maker, how far was that true of the animal world? Does it affect the insects or micro-organisms, for example? The Hebrew word *nephesh* (translated 'soul') is not applied to plants and seems to define the Scriptural concept of life (and so, death).

Various approaches to the answer have been suggested, most having their own difficulties. Two of such are:—

(a) If they were not a part of the original creation, there must have been extensive creative work after the Fall. This is not a position that is easy to defend biblically because the emphasis is on the curse, not on the creation of wonderful new features in the animals.

(b) Perhaps many of the features supporting predation and defense are actually adaptations. Some have argued, for example, that spiders used to catch pollen in their webs before the Fall. But this is not very attractive as a response because the adaptations are exquisite and often interrelated—spiders, for example, have rather impressive fangs which seem designed for predation.

Though we may not have the full answer, we need to keep certain facts in mind. God was not taken by surprise at the Fall, having to suddenly rethink His plans for man. He knew before creation that man would fall into sin and had planned his salvation back in eternity. The Scriptures make that plain. So, in His creative plan it is certain that He would have taken into account that there would be a change following man's rebellion.

Tentatively we would propose that at creation the predator and defense mechanisms were designed and the genetic information implanted. These functions could have remained dormant until 'triggered' following the Fall. This need not mean that each individual species was separately triggered, of course. There is such a balance in creation that the upset of the curse would have had a 'roll on' effect.

These functions would have remained dormant until the Fall. We know that there is a lot of apparently redundant DNA in the cell. Gradually we are finding that this (not surprisingly) does have a function and is expressed in situations not previously appreciated. There are genes that act as controls to initiate action by other genes in specific situations.

As an illustration of the principle, God created Eve to bear children. After the Fall, as a punishment for her part in the rebellion, women were to experience pain in childbirth, so that, at the very beautiful climax of her womanhood, she will be reminded of her sin. Similarly, with the Bombardier Beetle's defence system, the organs would have been present, but the generation of the active chemicals (or their reaction) may not have occurred until after the Fall.

This is almost certainly not the final word, but perhaps will help us in our question.

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Reader's Viewpoint

This is an occasional feature in which we give readers a chance to develop a point. As usual, the editors will only publish material that is in keeping with the Basis of Faith and Creation Manifesto, but it does allow an opportunity to write on themes without committing oneself to a full-length paper!

Origins

Graham Wilson

FEW will have been unimpressed by the recent event in our solar system when S-L9 (the Shoemaker-Levy comet) split up into pieces and crashed into the giant planet, Jupiter. Once again we have been vividly reminded of the energy and vastness of space and perhaps now is the time to take another look at origins.

If there is one subject which is certain to generate lots of heat, if not much light, it is the key matter of origins. Part of the reason is that the educational system and the media select and promote only one model out of several alternatives and this blinkered approach has affected us more than we realise.

Let me now briefly review the main beliefs in respect of origins. (There is, of course, the 'steady state' theory which still draws some support).

Big Bang and Evolution

This model is currently popular with the majority of scientists. About 15 billion years ago, the universe was thought to be somehow contained in a superdense nugget. (The origin of this unique fireball is simply presumed and the alleged date is arrived at on the suspect basis of extrapolation). For some reason this material was conveniently able to 'explode' with superlative precision, space dutifully expanded and stars, galaxies, the sun and the planets were ultimately formed.

About 4 billion years ago, so-called simple life is assumed to have arisen on earth from non-life as a sheer accident. That life has evolved by natural processes into the complex structures and designs we marvel at today. The evolution aspect is usually referred to as Darwinism or Neo-Darwinism, linked to the theories proposed by Charles Darwin last century.

Clearly there are real difficulties with the Big Bang idea which has failed to convince quite a large number of scientists. There is still no genuine fossil evidence to support the evolution model and Darwinists also openly confess the on-going quest for a credible explanation of their assumed mechanism for evolution. In these circumstances it is now acknowledged, even among Darwinists, that evolution or scientific naturalism is more of a philosophy or belief which people decide to adopt as opposed to belief in a Creator God. To accept Neo-Darwinism requires the exceptionally high level of faith that Nothing created Something out of Nothing!

Theistic Evolution

This model claims that God used or guided evolutionary processes to produce the diversity of life and wonder we enjoy today. God started it all off a long time ago and, as required, stepped in to ensure that everything gradually evolved to completion. Such a view is an attempt at compromise which has failed to satisfy both the evolutionist and the creationist whose models we shall consider shortly.

To the secular Darwinist or atheist, the concept of the Almighty is superfluous while, on the other hand, the creationist is most concerned about the treatment of Scriptures. The Word of God is set aside in order to infer, at least, that non-human hominids evolved on earth before our first parents 'arrived' on the scene.

Ancient Creation

Advocates of this model (and that of Recent Creation) are opposed to Darwinism and theistic evolution.

Ancient creationists normally believe that the Almighty made everything spread over æons of time and they therefore claim that the earth is very many millions of years old. The dating of Adam is usually avoided although some do give the distinct impression that he is of a comparatively recent origin. Due to the lengthy timescale involved with this view, it is generally assumed that there were other creatures and peoples on earth before the special creation of Adam and Eve. There is, of course, no Scriptural warrant for such a conjecture.

Ancient creationists adhere to their model because they are convinced that the earth is of great age. Christians, however, are to be encouraged not to base their outlook on scientific theories as they are notoriously prone to be revised or even rejected with the passage of time. Darwinism cannot survive without lots of time!

Recent Creation

Until around the start of the nineteenth century, the recent creation model was the normal one adopted in ecclesiastical and scientific circles. (What has basically changed since then is not so much the evidence but a novel way of looking at it).

Archbishop James Ussher of Armagh, Ireland published in 1650 a date of 4004 BC by adding up the ages provided in the Old Testament genealogies. Today this would put the earth's age at about 6,000 years and a 'ball park' figure of 10,000 to 15,000 years is acceptable to most recent creation scientists. This assessment is in accord with the known history and, what is more important, a straightforward approach to the Bible as a whole. Such a date is clearly not compatible with the Big Bang scenario which, however, is replete with problem areas, some of which have already been mentioned.

The Age of the Earth

A brief comment now needs to be made with regard to the age of the earth because, as previously noted, this estimate may actually determine, for some, their understanding of the early part of the Bible!

In conducting what really is an impossible task, various assumptions require to be made and each group naturally promotes the particular answers which seems to accord best with their outlook. It is, therefore, not unusual to play down or even ignore other dates as anomalous when they do not fit in with expected results. 'Mind set' actually does play a vital part in the whole exercise of dating!

Conclusion

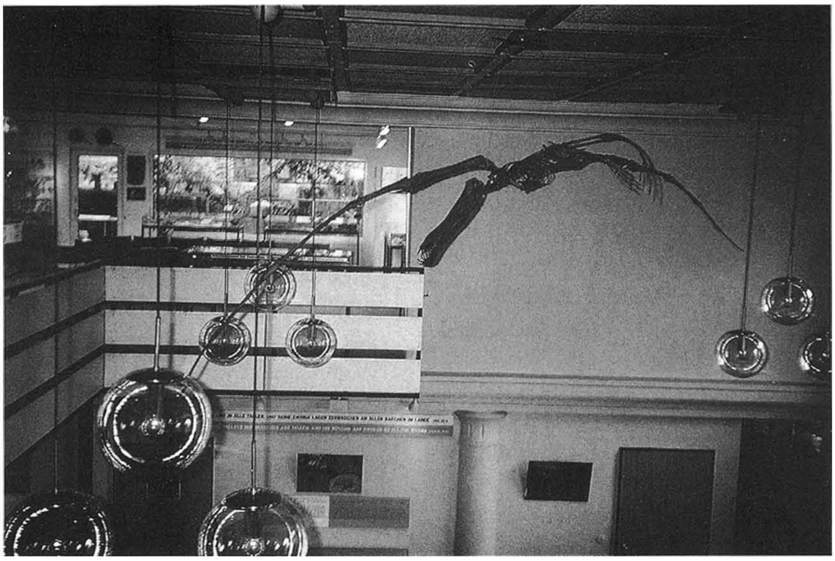
(i) Darwinism is a belief which is effectively dead but which cannot afford to be buried! The present theory is accepted, not because of the evidence, but in spite of it. It has to be upheld as the evolutionist has convinced himself that it is unthinkable to believe in a Creator.

(ii) All the observed evidence bears clear witness to God's direct creative activity. Ancient creationism, however, seems to have been unduly influenced by some evolutionary concepts.

(iii) The inspired writer to the Hebrews states: 'By faith we understand that the universe was formed at God's command, so that what is seen was not made out of what was visible'. (Hebrews 11:3). It was none other than the Lord Jesus Who confirmed that God made our first parents 'at the beginning of creation' (Mark 10:6)—and He should know!

THE AUTHOR

Graham Wilson is a chartered accountant serving the Edinburgh Medical Missionary Society which runs the Christian hospital in Nazareth, Israel. He is just completing a book entitled *Running out of Time.*

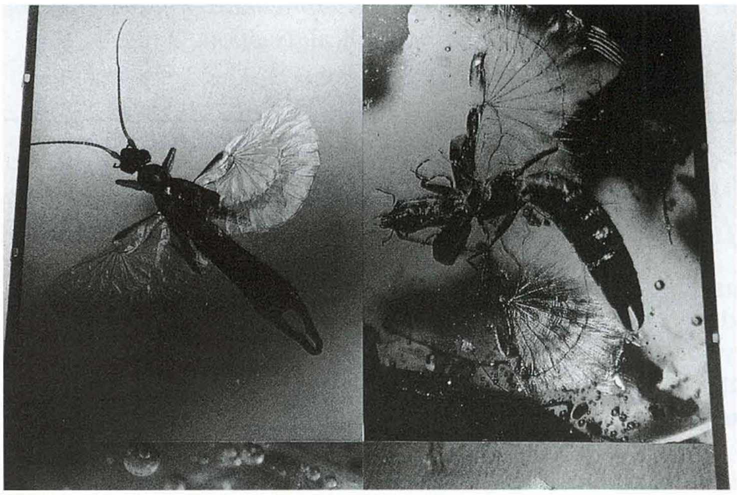


The interior of the Museum of Living Pre-history

News of Creation

Living Pre-history: a Museum dedicated to Creation and its Creator

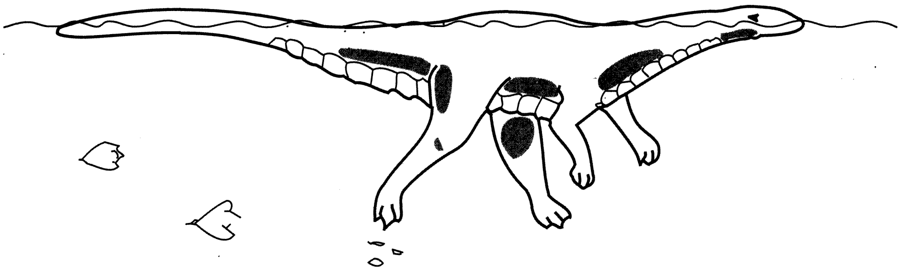
INCREASING numbers of British people are crossing the Channel to visit mainland Europe. So, presumably many Christians are doing the same. Why not include a Christian project in your visit? As you leave Ostende in Belgium, take the E40 motorway across the country and into Germany and head for Hagen. Hagen is just south of Dortmund. The journey from Ostende is 260 miles.



The owner and curator of the museum is Dr. Joachim Scheven, who is assisted by his wife. They have dedicated the last twelve years to this project. Parties from churches, youth groups and schools visit them, but there is no restriction on group size—they will be delighted to welcome small family parties too. The building was a former church which has been converted to house the museum and to provide living accommodation. Two lecture rooms (one small, one large) have been provided in the museum. The museum is funded by voluntary contributions.

The theme of the museum is simple—it is to demonstrate that palæontology does not provide evidence that the world is many millions of years old but, rather, is consistent with a doctrine of a young earth created and judged by God. Most of the museum is taken up with Dr. Scheven's marvellous fossil collection. However, an important part of the work consists of his 'living fossils'. He has collected plants and animals from all over the world that demonstrate his proposal that there has been no macro-evolutionary change with time. Very many fossils have modern counterparts. Even those fossils which represent extinct species demonstrate the sudden appearance of perfectly formed creatures or plants. The layout is attractive and informative.

Dr. Scheven will spend time explaining any points of interest to the visitor, but will not pressurize those who want to study quietly. The discerning visitor will detect some of the curator's own research themes, some of which have been described in articles written for the Biblical Creation Society. For example, the formation of coal and the existence of underground aquatic species before the Flood (Scheven, 1981). He is working on a paper arising from his studies on dinosaurs. The displays show that, long before the British Museum corrected its exhibits, he was claiming that the large tails were held parallel to the ground rather than dragging along it. But the tail still holds the key to further intriguing revelations! Dr. Scheven proposes that these creatures were aquatic, rather than land-based, living in the epi-continental seas of the post-Flood period. The loss of these seas led to their extinction. The tails are usually reconstructed as round, but the bone structure suggests a flatter form that would have provided a powerful propulsion system in the water. Others have voiced the same proposition (Coombs, 1980; Brand and Tang, 1991). Then, of course, that could provide an answer



Diagrammatic representation of a swimming dinosaur. The nature of the foot impressions in the unconsolidated sediment would be determined by the depth of the water at that point

to the old dilemma of dinosaurs and the ark—they would not have been in it!

The museum is a unique experience and is a 'must' for anyone interested in Creation and travelling anywhere within reach of middle Germany.

The address of the museum is Lebendige Vorwelt eV, Unterm Hagen 22, D–58119 Hagen. The telephone number is 010 49 2334 42444.

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FROM WHENCE COME WARS AND RUMOURS OF WARS?

Dr. Christopher Chippindale of Cambridge University was amazed at the details of a rock painting in Arnhem Land, Australia. He and Prof. Joan Vastokas of Trent University, Ontario noted, in the Cambridge Archæological Journal, that this art work contained large groups of people at war. Why is that a problem?

The *Daily Telegraph* (15th December 1994) reported anthropologist Vastokas as saying, 'This is completely contrary to what is generally supposed. There has always been a tendency to believe warfare was an evil invention of civilisation, before which the Earth was inhabited by "noble savages" who lived together in peace and harmony. We now, for the first time, have definite proof that this idea is wrong'. Chippindale makes the same point: 'These paintings will surprise those white Australians who hold what is called the "green fantasy," that the ancestors of the aborigines were "hopeless people" incapable of warfare'.

What a pity these scholars are not Bible students—they could have saved a lot of their research funds!

MOLECULAR EVOLUTION

'The evolutionary origins of most proteins are still obscure, many new structures appearing concomitantly with the appearance of new groups of organisms. Vertebrates, for example, have a host of proteins which are not found in invertebrates, and in most cases there is as yet no hint as to the ancestral proteins from which the new structures have emerged'.

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The Earth's Early Atmosphere

Continued from page 19

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Reviews

Grand Canyon: Monument to Catastrophe, edited by Steven A. Austin. Institute for Creation Research, 1994. 292 pages; $19.95

Reviewed by J. H. John Peet

FOR some years, geologist Dr. Steve Austin has been doing research on, and leading tours of, the Grand Canyon. This book is the product of such experience, but it contains contributions by other authors too. Besides the geological chapters, there are chapters on radiometric dating (Steve has done some valuable original research here), fossils, the ecosystem, the atmosphere and the early peoples of the region (including their traditions on the origin of the canyon). A final chapter gives some useful tips for the visitor.

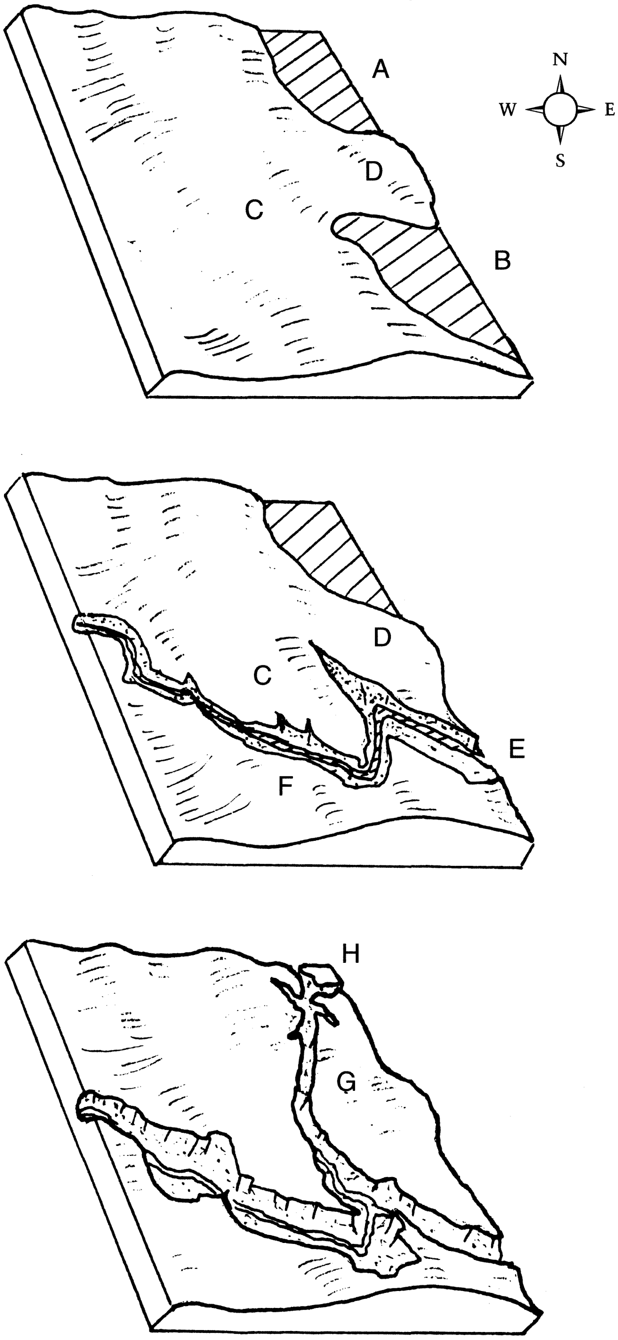
For most readers the climax is in chapters 4 and 5. If you do not know the geology and layout of the Grand Canyon, chapter 4 may be hard going, but it is worth the effort. In chapter 5 the authors postulate a 'breached dam theory' for the formation of the Grand Canyon. It is the proposal of the writers—not unique to these geologists and recognized in the traditions of the early peoples of the region—that the Colorado Plateau originally housed two great lakes: Canyonlands Lake (to the northeast) and Hopi Lake (southeast). The lakes would cover 30,000 square miles. The Hopi Lake then breached the dam of the Kaibab Upwarp to generate the Grand Canyon. This was followed by erosion by the Canyonlands Lake forming the Marble Canyon. (See figures). The writers do more than propose a theory. They examine the direct evidence and also show that their mechanism can be demonstrated from other known examples.

The authors must also be complimented on a very useful glossary which is invaluable to the non-specialist. Dr. Austin has already produced a video on Mount St Helens and a computer database on catastrophism. This book suggests (to me, at least!) the basis of a new video describing the catastrophic origin of the Grand Canyon, perhaps using models and computer simulations as well as *in situ* photography.

The book is not the final word on the subject and does outline many areas for creationist research. For example, there are tracks of vertebrates, but not their skeletal fossils (p.146). There is much more work to be done here, particularly since they suggest evidence of some quadrupeds much earlier than expected on an evolutionary hypothesis. The breached dam theory of erosion still leaves loose ends. The alternative models to radiometric isochron dating are to be followed up. And so on.

This is an invaluable resource book for the creationist and has thought-provoking material for those holding non-catastrophic views of the origin of the Grand Canyon.

A	*Canyonlands Lake*	*B*	*Hopi Lake*
C	*Kaibab Upwarp*	*D*	*Echo Cliffs*
E	*Little Colorado River*	*F*	*Grand Canyon*
G	*Marble Canyon*	*H*	*Upper Colorado River / Glen Canyon*



Breached dam theory for the formation of Grand Canyon
(based on figure 5.9, page 94 of the book reviewed)

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